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SARDAR PATEL UNIVERSITY

B.Sc. EXAMINATION(Semester- 5)

Thursday, 24th December,2020

2:00 p.m. to 4:00 p.m.

Subject: PHYSICS

Course: US05CPHY21

Title: Classical Mechanics

Total Marks:70

N.B: (i) All the symbol have their usual meanings

(ii) Figures at the right side of questions indicate full marks

Q-1 Multiple Choice Questions (Attempt All) (10)

(1) The degree of freedom for N particles in plane are _____

(a) N (b) 2N

(c) 3N (d) 2

(2) _____ constraints are independent of time

(a) Holonomic (b) Non-Holonomic

(c) Scleronomous (d) Rheonomous

(3) The generalized coordinates for spherical pendulum are _____

(a) α & θ (b) θ & ϕ

(c) α & ϕ (d) 0 & ϕ

(4) If the moving frame of reference is accelerated the effective force acting on the particle is _____ than the actual force

(a) zero (b) equal

(c) smaller (d) higher

(5) A rigid body have _____ degree of freedom

(a) one (b) two

(c) three (d) six

(6) The path of a particle is _____when it is moving under constant conservative force field

(a) cycloid (b) hyperbolic

(c) parabolic (d) straight line

(7) The equation of constraints for a simple pendulum is _____

(a) $r\,d\theta - l = 0$ (b) $r - l = 0$

(c) $r + l = 0$ (d) $r\,d\theta + l = 0$

(8) For conservative system, the potential energy is a function of _____

(a) position (b) velocity

(c) force (d) acceleration

(9) The space depends on position coordinate and momenta is called _____ space

(a) configuration (b) phase

(c) coordinate (d) momentum

(10) The Poisson brackets are _____

(a) non additive (b) non-distributive

(c) commutative (d) anti-commutative

Q-2 True-False and Filling the blanks (08)

(1) When the constraints are depends on the time are known as Rheonomous constraints (True/False)

(2) The study of conservation theorems for a system in motion provides the constants of motion (True/False)

(3) In a torque free motion of a rigid body, the angular velocity of the body is a constant vector (True/False)

(4) If $I_1 = I_2$ and $I_3 = 0$, then the body is called symmetrical top (True/False)

(5) In variational principle the line integral of some function between two end points is _____

(6) The Lagrangian for L-C-R series connection is $L =$ _____

(7) For conservative system H= _____

(8) In Hamiltonian formulation potion coordinate and _____ taken as independent variable

Q-3 Short Questions (Attempt any Ten) (20)

(1) What are generalised coordinates?

(2) Write the advantages of Lagrangian formulation

(3) Write the Maxwell's equations

(4) Find the angular velocity of the earth

(5) Show that the directions of the angular velocity and the angular momentum are different

(6) Define inertial and non-inertial frame of reference

(7) State the Hamilton's principle

(8) What is necessity of undetermined multipliers?

(9) What is configuration space?

(10) Construct the Lagrangian for simple pendulum with moving support

(11) What is a phase diagram?

(12) What is Generating function?

Q-4 Long Questions (Attempt any four) All questions carry equal marks (32)

(1) Derive $\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_j}\right) - \frac{\partial L}{\partial q_j} = 0$ using D'Alembert's principle

(2) Derive the Lagrange's equation of motion for a Rayleigh's dissipation function

(3) Explain the motion of the earth with necessary diagrams

(4) Derive the expressions of angular momentum and kinetic energy for motion of rigid body

(5) Discuss the technique of calculus of variation and derive the Euler's equation $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$

(6) Construct the Lagrangian and derive the equations of motion for a cylinder rolling on inclined plane using undetermined multiplier

(7) Deduce the Hamilton's equation of motion and show that H is a constant of motion and also give the total energy

(8) Discuss the Canonical transformation and derive the Canonical transformation equation for $F_1 = F_1(q_i, Q_i, t)$

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